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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]Between the exothermic electronic component which this invention generates heat by operating, serves as an elevated temperature from a room temperature, and can serve as an electromagnetic wave source, and heat leakage members (radiating part), such as a heat sink and the circuit board, It is related with the electromagnetic-wave-absorbing nature heat-conduction constituent, thermosoftening electromagnetic-wave-absorbing nature radiation sheet, and heat dissipation execution method for forming the electromagnetic-wave-absorbing nature radiating member arranged for cooling of the electronic parts by heat conduction, and electromagnetic wave absorbing.

[0002]

[Description of the Prior Art]Television, radio, the computer, the medical device, the business machine, the communication apparatus of the circuit design of the latest electronic equipment, etc. are increasing complexity. For example, the integrated circuit which includes 100,000 transistor counts for the apparatus of these and others came to be manufactured. Thus, while the complexity of the design is increasing, still smaller electronic parts are manufactured, the capability to increase further the device surface product reduced increasingly, and to include the number of these parts in it is improving, and the size of a device is miniaturized succeedingly.

[0003]For this reason, since failure or malfunction arises with the heat generated from each part article, the method of making the heat generated from electronic parts radiate effectively is needed.

[0004][In LS] used for electronic equipment, such as electronic parts especially a personal computer, a digital videodisc, and a cellular phone, on the other hand, such as CPU, a driver, IC, and a memory, Generating of harmful electromagnetic waves anxious about the influence on failure by interference of electronic parts, malfunction, malfunction, or a human body poses a problem with the shift to the high frequency for highly-efficient-izing at the same time the problem in the above-mentioned generation of heat occurs with improvement in a degree of location.

[0005>About the heat generated from electronic parts, in order to reduce this, the heat leakage member and constituent which are used for many heat leakage methods and it are proposed. Conventionally, in electronic equipment etc., in order to suppress the rise in heat of electronic parts during the use, heat sinks which used the metal plate with high thermal conductivity, such as brass, are used. This heat sink conducts the heat which those electronic parts generate, and emits that heat from the surface according to a temperature gradient with the open air.

[0006]In order to tell the heat generated from electronic parts efficiently to a heat sink, it is necessary to stick a heat sink to electronic parts but, and. Since there is common difference by a difference and attachment processing of the height of each electronic parts, the heat conduction sheet which has pliability, and thermally conductive grease were made to infix between electronic parts and a heat sink, and heat conduction from electronic parts to a heat sink has been realized via this thermally conductive sheet or thermally conductive grease. Although the sheet for heat conduction (thermally conductive silicone rubber sheet) formed with thermally conductive silicone rubber etc. is used as the above-mentioned thermally conductive sheet, with these sheets, there is a problem in interfacial heat resistance.

[0007]Then, a thermosoftening sheet which is indicated in thermally conductive grease or the ** table No. 509209 [2000 to] gazette is proposed as a lowering method of interfacial heat resistance. However, each of these is limited to a radiating member, and it is not combined [have the electromagnetic-wave-absorbing performance and].

[0008]Many trials which, on the other hand, cover the electromagnetic waves generated from electronic parts are made conventionally. Although there are generally many using metal, plating, or a conductive composition, each of these uses the function to reflect electromagnetic waves. The sheet member already filled up with the soft magnetism powder or the ferrite through organic rubber, especially chlorinated polyethylene as an electromagnetic-wave-absorbing ingredient is marketed. However, these sheets were upright and electromagnetic wave shielding power was powerless about the heat leakage of what is accepted.

[0009]The material it has material and heat conduction and electromagnetic-wave-absorbing ability these days is proposed. For example, in JP,11-335472,A, silicon gel etc. are made to contain ferrites, such as a Mn-Zn ferrite and a nickel-Zn ferrite, and it is proposed with the structure produced to the sheet shaped that the noise suppression effect is acquired. However, since this sheet is filled up with an electromagnetic-wave-absorbing nature filler, it becomes hard, and since thermal conductivity is also low, it is not enough as a heat leakage member.

[0010]In this invention, it was made in view of the above-mentioned problem.

Therefore, it aims at excelling in radiation performance and providing the thermosoftening electromagnetic-wave-absorbing nature radiation sheet and heat dissipation execution method which formed in the sheet shaped an electromagnetic-wave-absorbing nature heat-conduction constituent and this excellent in the electromagnetic-wave-absorbing nature which controls generating of an electromagnetic wave noise.

[0011]

[The means for solving a technical problem and an embodiment of the invention] In order to attain the above-mentioned purpose with this invention, as a result of inquiring wholeheartedly, contain an electromagnetic-wave-absorbing nature filler and at ordinary temperature by a solid state. The constituent which is not hardened [which can be easily formed in heat softening, hypoviscosity-izing, or the shape that dissolves, and begins and needs a sheet in a fixed temperature requirement] is used between an exothermic electronic component and a radiating part (boundary).

Therefore, wearing to electronic parts or a heat sink and desorption were easy, and softened with the heat generated at the time of operation of electronic parts, interface thermal contact resistance was reduced, and radiation performance improved by this, and it found out excelling in the electromagnetic-wave-absorbing nature which controls generating of an electromagnetic wave noise.

[0012]Namely, at ordinary temperature, are a solid and heat softening, hypoviscosity-izing, or the ingredient to dissolve is chosen in a fixed temperature requirement, By arranging the constituent which filled up this ingredient with the filler which has electromagnetic-wave-absorbing performance, and was further filled up with the thermally conductive filler as occasion demands between an exothermic electronic component and a radiating part (boundary), the knowledge of the ability to attain desired electromagnetic-wave-absorbing performance and heat leakage is carried out, and it comes to make this invention.

[0013]Therefore, this invention generates heat by operating and serves as a temperature higher than a room temperature, It is a heat-conduction constituent for electromagnetic-wave-absorbing nature radiating member formation arranged between an exothermic electronic component and a radiating part used as an electromagnetic wave source, An electromagnetic-wave-absorbing nature heat-conduction constituent which is non fluidity in a room temperature state before electronic-parts operation, and is characterized by filling up substantially generation of heat at the time of electronic-parts operation without an opening between the above-mentioned electronic parts and a radiating part when it softens or dissolves and the surface mobilizes at least, hypoviscosity-izing and is provided. This invention provides a thermosoftening electromagnetic-wave-absorbing nature radiation sheet which formed this constituent in a sheet shaped. This invention generates heat by operating and serves as a temperature higher than a room temperature, By arranging the above-mentioned electromagnetic-wave-absorbing nature heat-conduction constituent between an exothermic electronic component and a radiating part used as an electromagnetic wave source, operating the above-mentioned exothermic electronic component and making it generate heat, the above-mentioned constituent -- hypoviscosity-izing -- softening or dissolving, and the surface being made to mobilize at least, and. An execution method of an electromagnetic-wave-absorbing nature heat-conduction constituent by which pressing the above-mentioned constituent and being substantially filled up without an opening between the above-mentioned electronic parts and a radiating part at least from one side of the above-mentioned exothermic electronic component and a radiating part is provided.

[0014]Hereafter, this invention is explained in detail. An electromagnetic-wave-absorbing nature heat-conduction constituent of this invention reaches a temperature higher than a room temperature operating, especially by impressing voltage, It is a constituent used as an electromagnetic-wave-absorbing nature radiating member arranged between an exothermic electronic component and a radiating part (boundary) which can serve as an electromagnetic wave source, In the usual room temperature state before electronic-parts operation, it is illiquid and is maintained by state which can be conveyed by holding to a state or substrates of a cast, such as a sheet shaped, etc., A boundary of electronic parts and a radiating part is substantially filled up hypoviscosity-izing and by softening or dissolving by generation of heat at the time of electronic-parts operation, In this case, a boundary of electronic parts and a radiating part is filled up by hanging press at least from one side of electronic parts and a radiating part preferably at the time of generation of heat of electronic parts.

[0015]As for an electromagnetic-wave-absorbing nature heat-conduction constituent of this invention, when an organic binder component, an electromagnetic-wave-absorbing nature filler, and also thermal conductivity are required, it is preferred that it is a thing containing these and a thermally conductive filler. Hereafter, each of these ingredients and a manufacturing method of a constituent are explained in full detail.

[0016]As an organic binder component which can serve as a medium (matrix) of an electromagnetic-wave-absorbing nature heat-conduction constituent of organic binder component this invention, In [below highest arrival temperature a constituent is a solid at

ordinary temperature substantially are not less than 40 °C preferably, and according to generation of heat of an exothermic electronic component / about 40-100 °C] an about 40-90 °C temperature requirement especially specifically, As long as it is heat softening, hypoviscosity-izing, or a thing that is dissolved and the surface mobilizes at least, what kind of thing may be used, A temperature requirement at the time of an operation of alpha olefin, silicone resin, a wax, wax, etc., A substance which has the melting point at 40-100 °C preferably (this is hereafter called low melting point material), A substance which becomes softening or a thing which hypoviscosity-izes and is liquid at temperature at the time of an operation although it does not have the melting point in a temperature requirement at the time of the above-mentioned operation. In a temperature requirement at the time of (this is hereafter called heat mobilization substance) and the above-mentioned operation A starch syrup-like substance, Or thermoplastics and/or thermosetting resin which have the melting point to a temperature higher than a temperature requirement at the time of the above-mentioned operation, or do not have the melting point in it in essence, and the above-mentioned low melting point material, A mixture (heat softening is carried out as the whole constituent) with a heat mobilization substance or a starch syrup-like substance, etc. are mentioned, and a mixture with thermoplastics and/or thermosetting resin, low melting point material, a heat mobilization substance, or a starch syrup-like substance is preferred.

[0017]As an organic binder, in this case, a polyolefine system polymer, an acrylic polymer, Although a constituent serves as a fluid and does not flow out, including one sort of a fluorine system polymer and a siloxane system polymer, or two sorts or more, it is preferred that low melting point material, a heat mobilization substance, or a starch syrup-like substance is included so that heat softening, hypoviscosity-izing, or fusion may be caused. When fire retardancy is needed, it is preferred that a fluorine system polymer and a siloxane system polymer are included. In the case of a fluorine system polymer, a liquefied fluoro-resin is preferred and a copolymer of a hexafluoro propene / vinylidene fluoride / tetrafluoroethylene is especially preferred. In the case of a siloxane system polymer, what softening, hypoviscosity-izing or a thing to dissolve, and a thing which has the melting point above a room temperature like alkyl modification silicone were mentioned when it is a solid and was heated at a room temperature like silicone resin, and contained silicone resin is preferred. A polymer which included $\text{RSiO}_3/2$ unit, and/or a SiO_2 unit in order to maintain non fluidity at ordinary temperature, Or a copolymer (silicone resin) of these and an R_2SiO unit, a mixture of silicone resin and linear polysiloxane (silicone raw rubber, silicone oil), etc. are mentioned as a suitable material (R is a monovalent hydrocarbon group).

[0018]As for a constituent, as mentioned above, in order to generate a critical viscosity down, it is desirable to make oligomer, a wax, etc. of a low polymerization degree contain comparatively. Specifically, low melting point material, such as alpha olefin, wax, a wax, acrylic oligomer, silicone resin, and fluorine system oligomer, a heat mobilization substance, and a starch syrup-like substance are used. In this case, as for low melting point material and a heat mobilization substance, what is while the melting point or softening temperature is 40-100 °C is preferred.

[0019]a polyolefin system (desirable -- EP.) which does not have the melting point in the above-mentioned operating temperature range in particular in this invention What mixed a substance which has the melting point in the above-mentioned operating temperature ranges which were described above to an EPDM polymer, an acrylic polymer, a fluorine system polymer, or a siloxane system polymer, such as alpha olefin, wax, a wax, and silicone resin, is preferred.

[0020]The blending ratio is not restricted especially if a constituent is a range which is a solid at a room temperature and mobilizes by generation of heat at the time of electronic-parts

operation and with which it comes to fill up without an opening, but [especially] it is preferred that it is 20 to 80 % of the weight ten to 100% of the weight of an organic binder component. [0021]As an organic binder component of this invention, What gives pliability and tuck nature (needed for electronic parts or a heat sink from the necessity of carrying out the temporary stop of the radiation sheet) to a constituent of this invention is preferred, Since a sheet excellent in balance of pliability and tuck nature is obtained and it becomes advantageous when two or more kinds of polymers etc. in which viscosity differs are mixed and used, although a polymer of single viscosity, etc. may be used, it is preferred to use two or more kinds from which viscosity differs.

[0022]As for an above-mentioned polymer thru/or a constituent, it can be preferred to construct a bridge once, heat softening or after dissolving, and it can raise reworkability by this. Namely, after this constituent sticks to an exothermic electronic component and a radiating part by carrying out heat softening once, It can remove from electronic parts and a radiating part easily by following in footsteps of expansion contraction by heat, holding low-fever resistance by constructing a bridge, and constructing the bridge, when a rework is required. Therefore, it is preferred to make this constituent into hardenability by crosslinking reaction from this point.

[0023]For such a purpose, it is preferred that the above-mentioned polymer has a hardening reactive functional group in an end or a side chain. As such a functional group, OH, COOH, an aliphatic unsaturated group, a glycidyl group, a norbornene group, etc. are usually mentioned by polyolefin system resin and acrylic resin. CH basis of a vinylidene fluoride group, etc. are used for bridge construction in fluororesin, and an aliphatic unsaturated group, a silanol group, alkoxy silyl groups, etc. may be used for bridge construction in a siloxane system polymer.

[0024]It is preferred to use at least one sort chosen from metal system ferromagnetic powder and oxide stock ferromagnetic powder as an electromagnetic-wave-absorbing nature filler used for electromagnetic-wave-absorbing nature filler this invention, metal system ferromagnetic powder and oxide stock ferromagnetic powder may use one sort independently, and it may mix and they may use it.

[0025]As metal system ferromagnetic powder, an alloy containing iron and iron is preferred. As a ferromagnetic iron alloy, a magnetic alloy of a Fe-nickel system, a Fe-Co system, a Fe-Cr system, a Fe-Si system, a Fe-aluminum system, a Fe-Cr-Si system, a Fe-Cr-aluminum system, a Fe-aluminum-Si system, a Fe-B-Si system, a nickel-Fe system, and a Co-Fe-nickel-Si-B system, etc. can be used. These metal system ferromagnetic powder may be used by an one-sort independent, and may use two or more sorts of combination.

[0026]Although whichever of flat shape and particle state may be used as shape of metal system magnetic powder, it is more desirable to use flat shape, since electromagnetic-wave-absorbing performance is good. Since a fill ration decreases easily in using metal system soft magnetism powder of flat shape, metal system soft magnetism powder of particle state may be used together.

[0027]In this case, especially as a size of flat shape powder, 0.1-350 micrometers of average length between couplings are 0.5-100 micrometers, and a thing of 2-50 has a preferred aspect ratio. In the case of particle state powder, it is preferred that mean particle diameter uses especially 0.1-100 micrometers of things which are 0.5-50 micrometers.

[0028]As oxide stock ferromagnetic powder, a ferrite is preferred. As a ferrite, specifically ZnFe_2O_4 , MnFe_2O_4 , MgFe_2O_4 , CoFe_2O_4 , NiFe_2O_4 , CuFe_2O_4 , Fe_3O_4 , a Cu-Zn-ferrite, a nickel-Zn-ferrite, A spinel ferrite, $\text{Ba}_2\text{Co}_2\text{Fe}_{12}\text{O}_{22}$ which make a Mn-Zn-ferrite basic composition, $\text{Ba}_2\text{nickel}_2\text{Fe}_{12}\text{O}_{22}$, $\text{Ba}_2\text{Zn}_2\text{Fe}_{12}\text{O}_{22}$, $\text{Ba}_2\text{Mn}_2\text{Fe}_{12}\text{O}_{22}$, $\text{Ba}_2\text{Mg}_2\text{Fe}_{12}\text{O}_{22}$, $\text{Ba}_2\text{Cu}_2\text{Fe}_{12}\text{O}_{22}$, a FEROKUSU planer which makes $\text{Ba}_3\text{Co}_2\text{Fe}_{24}\text{O}_{41}$ basic composition (Y

molds) Z type mold hexagonal ferrite, BaFe₁₂O₁₉, SrFe₁₂O₁₉, and/or BaFe₁₂O₁₉, A MAGUNE plan byte (M type) mold hexagonal ferrite etc. which make basic composition what replaced Fe element of SrFe₁₂O₁₉ with Ti, Co, Mn, Cu, Zn, nickel, and Mg can be used. These ferrites may be used by an one-sort independent, and may be used combining two or more sorts.

[0029]Although whichever of flat shape and particle state may be used as shape of oxide stock magnetic powder, it is more desirable to use flat shape from a point that surface area is large. Since a fill ration decreases easily in using oxide stock magnetic powder of flat shape, oxide stock magnetic powder of particle state may be used together.

[0030]In this case, especially as a size of flat shape powder, 0.1-350 micrometers of average length between couplings are 0.5-100 micrometers, and a thing of 2-50 has a preferred aspect ratio. In the case of particle state powder, it is preferred that mean particle diameter uses especially 0.1-100 micrometers of things which are 0.5-50 micrometers.

[0031]As for loadings of these electromagnetic-wave-absorbing nature filler, it is desirable that it is 150 to 1600 weight section preferably 100 to 3000 weight section to organic binder component 100 weight section. When there are too few loadings of an electromagnetic-wave-absorbing nature filler, there is a possibility that electromagnetic-wave-absorbing performance may become less enough, when too large, mobility at the time of heat softening at the time of generation of heat, hypoviscosity-izing, and fusion becomes less enough, and since it becomes a constituent in a room temperature is hard and weak, there is a possibility that sheet forming may become difficult.

[0032]Only by combination of the thermally conductive filler above-mentioned medium and an electromagnetic-wave-absorbing nature filler, an effect of heat conduction is scarce, and when the further heat leakage effect is searched for, a thermally conductive filler can be used, combining it with the above-mentioned ingredient.

[0033]As a thermally conductive filler used for this invention: Metal, such as nonmagnetic copper and aluminum, alumina, silica, magnesia, Substances generally used as a thermally conductive filler, such as metal nitrides, such as metallic oxides, such as red ochre, beryllia, a titania, and zirconia, aluminum nitride, silicon nitride, and boron nitride, a synthetic diamond, or silicon carbide, can be used. These thermally conductive fillers may be used by an one-sort independent, and may be used combining two or more sorts.

[0034]As for these thermal-conductivity filler, it is preferred that mean particle diameter uses especially 0.1-100 micrometers of things which are 0.5-50 micrometers like an electromagnetic-wave-absorbing nature filler. As shape, the shape of a ball may be desirable, this may be used by an one-sort independent, and two or more sorts from which shape differed may be mixed and used. For thermally conductive improvement, considering it as combination which approaches minute restoration using particles from which mean particle diameter differs two or more sorts is recommended.

[0035]As for especially loadings of a thermally conductive filler, it is preferred that it takes 100 to 2500 weight section for 1000 to 2000 weight section to organic binder component 100 weight section. When there are too few loadings of a thermally conductive filler, there is a possibility that heat-conduction performance may become insufficient, and when too large, there is a possibility that sheet processability and workability may worsen.

[0036]As for an electromagnetic-wave-absorbing nature heat-conduction constituent of other additive agent this inventions, an additive agent usually further used for a synthetic rubber as an optional component, a filler, etc. can be used in the range which does not spoil the purpose of this invention. As a release agent, specifically Silicone oil, a fluoride denaturation silicone surface-active agent, etc., As colorant carbon black, a titanium dioxide, red ochre, etc. as a flame retarder A halogenated compound, Rubber, process oil used at the time of plastic

combination, reactant Silang or a siloxane, a reactant titanate catalyst, a reactant aluminum catalyst, etc. can usually be added as processability enhancement agents, such as a phosphorus compound and a platinum catalyst.

[0037]A manufacturing method of an electromagnetic-wave-absorbing nature heat-conduction constituent of manufacturing method this invention, It can obtain by mixing uniformly by heating each above-mentioned ingredient using rubber ** machines, such as 2 rolls, a Banbury mixer, a dough mixer (kneader), a gate mixer, and a planetary mixer, depending on the case.

[0038]As a manufacturing method of a thermosoftening electromagnetic-wave-absorbing nature radiation sheet, it can fabricate and obtain to a sheet shaped by [which carry out back coating] having dissolved a constituent after the above-mentioned kneading in extrusion molding, calender molding, roll forming, press forming, and a solvent.

[0039]As for thermal conductivity of an obtained electromagnetic-wave-absorbing nature heat-conduction constituent and a thermosoftening electromagnetic-wave-absorbing nature radiation sheet, it is preferably desirable that it is 1 - 20 W/mK 0.5 or more W/mK. In thermal conductivity, in less than 0.5 W/mK, thermal conductivity between electronic parts and radiating parts, such as a heat sink, becomes low, and there is a possibility that sufficient radiation performance may not be demonstrated.

[0040]As for viscosity at 80 ** of the above-mentioned constituent and a sheet, it is desirable 1×10^2 - 1×10^5 Pa-s, and that they are 5×10^2 - 5×10^4 Pa-s preferably. There is a possibility that viscosity may flow out from between electronic parts and radiating parts, such as a heat sink, by less than 1×10^2 Pa-s. If 1×10^5 Pa-s is exceeded, thermal contact resistance may become large, thermal conductivity between electronic parts and radiating parts, such as a heat sink, becomes low by this, and sufficient radiation performance may not be demonstrated.

[0041]As for a plasticity number (JIS K 6200) at 25 ** of the above-mentioned constituent and a sheet, it is desirable 100-700, and that it is the range of 200-600 preferably. If wearing handling nature to electronic parts may worsen by less than 100 and a plasticity number at 25 ** exceeds 700, sheet processability and wearing handling nature to electronic parts may worsen.

[0042]Thus, an electromagnetic-wave-absorbing nature heat-conduction constituent and a thermosoftening sheet which were obtained, Wearing to radiating parts, such as electronic parts and a heat sink, and desorption are easy, since interface thermal contact resistance of electronic parts and a radiating part is reduced by hypoviscosity-ization and softening or dissolving by generation of heat at the time of electronic-parts operation, excel in radiation performance, and. It excels in electromagnetic-wave-absorbing nature which controls generating of an electromagnetic wave noise.

[0043]In this case, the above-mentioned constituent or a sheet is arranged between an exothermic electronic component and a radiating part which generate heat by operating, serve as a temperature higher than a room temperature, and serve as an electromagnetic wave source. Under the present circumstances, although full adhesion of between the above-mentioned constituent or a sheet, and electronic parts is not carried out but it has a minute cavity part, The above-mentioned constituent or a sheet is softening, hypoviscosity-izing, or a thing it dissolves, and the surface mobilizes at least, buries the above-mentioned minute cavity part, and carries out full adhesion with electronic parts and by which interface thermal contact resistance is reduced as mentioned above by generation of heat by operation of these electronic parts. In this case, it is preferred to apply thrust to the above-mentioned constituent or a sheet at least from one side of the above-mentioned

electronic parts and a radiating part, and to secure better adhesion.

[0044]Although a kind of the above-mentioned exothermic electronic component does not have restriction in particular, by impressing voltage, electromagnetic waves are generated and a constituent or a sheet of this invention is effective to exothermic electronic components, such as what generating heat, for example, a personal computer etc.

[0045]

[Example]Although an example and a comparative example are shown and this invention is explained concretely hereafter, this invention is not restricted to the following example.

[0046][Examples 1-4] The softening temperature which consists of a mixture which uses an acrylic resin and an electromagnetic-wave-absorbing nature filler as the main ingredients produced the thermosoftening electromagnetic-wave-absorbing nature radiation sheet which formed a not less than 40 ** acrylic thermal-conductivity electromagnetic-wave-absorbing nature constituent in the sheet shaped by the following procedure.

[0047]Paraffin wax was used as a heat softening ingredient, using an acrylic resin as a resinous principle of an acrylic thermal-conductivity electromagnetic-wave-absorbing nature constituent. As other ingredients, the carbon functional silane was used as a finishing agent of an electromagnetic-wave-absorbing nature filler and a thermally conductive filler. A feed ingredient ingredient is shown below.

[0048]Raw material explanation 1 paraffin wax, the paraffin wax 115 (melting point of 47 **), The paraffin wax 130 (melting point of 55 **), and all The trade name 2 acrylic resin by Nippon Seiro Co., Ltd., The finishing agent of SK dyne 1310 (32 to 34% of a nonvolatile matter and the remainder are solvents), and Soken Chemical & Engineering trade name 3 powder : A carbon functional silane, KBM-3103, a Shin-Etsu Chemical Co., Ltd. make trade name 4 thermal-conductivity filler : Alumina powder, AS30, Showa Denko K.K. make trade name 5 electromagnetic-wave-absorbing nature filler:Fe-Cr (metal system soft magnetism spherical powder), PMIC-15, Daido Steel Co., Ltd. make trade name 6 electromagnetic-wave-absorbing nature filler:Fe-Cr (metal system soft magnetism flat shape powder), PMIC-15F, the trade name by Daido Steel Co., Ltd. [0049]The raw material of the combination formula shown in thermosoftening electromagnetic-wave-absorbing nature radiation sheet production procedures and the quality assessment table 1 was supplied to the homogenizer (churning dissolving machine), and agitation mixing was carried out at the room temperature for 1 hour. After coating the obtained solution with a comma coating machine on the PET film which applied the release agent, in 100 ** atmosphere, by heating for 10 minutes, a part for a solvent (volatile matter content) was removed, and the sheet (300 mm in width and 0.5 mm in thickness) was produced.

[0050]After piercing and molding the obtained thermosoftening electromagnetic-wave-absorbing nature radiation sheet in predetermined shape and removing the PET film, a noise extinction ratio, a plasticity number, thermal conductivity, thermal resistance, viscosity, and a heat softening point were measured with the following valuation method.

1) Noise magnitude-of-attenuation measuring method : a measuring block figure is shown in drawing 1.

[0051]PC2 which put the thermosoftening electromagnetic-wave-absorbing nature radiation sheet (30 mm in width, 30 mm in length, and 0.5 mm in thickness) of this invention between CPU (clock frequency of 533 MHz) and the heat sink made from aluminum was installed in the anechoic chamber 1, and the receiving antenna 3 was installed in the position which was further 3 m away from the PC2. That is, this agrees by the FCC 3-m basing method. Four in drawing 1 is a display and 5 is a keyboard. Subsequently, PC2 was started and it measured with the EMI receiver (spectrum analyzer) 7 in the shield room 6 which connected the

generated noise with the receiving antenna 3. The power supply of the display 4 connected with PC2 at the time of measurement was set to OFF, and it prevented receiving the noise from the display 4.

2) Plasticity number measuring method : it measured by the plasticity number examination of JIS K 6249.

3) The thermal conductimetry method : it measured by thermal conductimetry machine QTM-500 (trade name made from the Kyoto electrical machinery).

4) Thermal resistance measuring method : on both sides of the sample with a thickness of 0.5 mm pierced to transistor TO-3 mold configuration, load was carried out by compression load 300 gf/cm^2 between transistor 2SD923 (Fuji Electric trade name) and heat sink FBA-150-PS (trade name by OS Co., Ltd.). The heat sink was put in the constant temperature bath, and kept it warm at 60 **. Next, the electric power of 10V and 3A was supplied to the transistor, the temperature of the thermo couple currently embedded at the transistor (temperature T_1) and heat sink (temperature T_2) of 5 minutes after was measured, and the thermal resistance R_s (**/W) of the sample was computed from the following formula. $R_s = (T_1 - T_2) / 305$ viscosity measurement method: It measured by the ARES viscoelasticity system (made by a LEO metric scientific company).

6) Heat softening point measuring method : it measured with the BIKATTO softening temperature test method of JIS K 7206.

[0052]The following standard estimated sheet processability, pliability, tuck nature, and handling nature. These results were shown in Table 1.

Valuation-basis sheet processability: Extrusion-molding nature was evaluated.

Pliability: The crack initiation state at the time of bending a sheet at 90 degrees estimated.

Tuck nature: As shown in drawing 2, it installed in the heat sink 11 surface, it was neglected in the 5-minute interspace so that the radiation sheet 12 might turn down, and the existence of exfoliation omission estimated.

Handling nature: Handicraft performed wearing nature of heat SHINKUHE and it was evaluated.

O : A O: good **: It is good a little. x: Defect [0053]

[Table 1]

原料 (重曹部)	実施例 1	実施例 2	実施例 3	実施例 4
α-テトラメチルシロキサン	0	50	0	50
α-テトラメチルシロキサン	50	0	50	0
SK デイ 1310	150	150	150	150
KBM-9108	5	5	5	5
AS90	0	900	0	900
PMIC-15	900	900	0	0
PMIC-16F	0	0	350	350
ノイズ減衰係数 at 1GHz (dB)	-11.2	-8.8	-13.5	-12.1
可塑性 at 25°C	310	500	250	300
熱伝導率 (W/mK)	1.3	3.8	0.9	1.8
熱抵抗 at 60°C (°C/W)	0.09	0.03	0.10	0.06
粘度 at 80°C (Pa·s)	5×10^4	3×10^4	2×10^4	1×10^4
熱軟化点 (°C)	40~80	40~80	40~80	40~80
シート加工性	○	○	○	○
柔軟性	◎	△	◎	○
タック性	◎	○	◎	◎
取り扱い性	△	△	△	△

[0054][Examples 5-8] The softening temperature which consists of a mixture which uses a fluoro-resin and an electromagnetic-wave-absorbing nature filler as the main ingredients produced the thermosoftening electromagnetic-wave-absorbing nature radiation sheet which formed a not less than 40 ** fluoro-resin system thermal-conductivity

electromagnetic-wave-absorbing nature constituent in the sheet shaped by the following procedure.

[0055]As a heat softening ingredient, 3 element-system resin which consists of polyvinylidene fluoride-hexafluoropropylene tetrafluoroethylene was used, using a liquefied fluoro-resin as resin of a fluoro-resin system thermal-conductivity electromagnetic-wave-absorbing nature constituent. As other ingredients, the carbon functional silane was used as a finishing agent of an electromagnetic-wave-absorbing nature filler and a thermally conductive filler. A feed ingredient ingredient is shown below.

[0056]Raw material explanation 1 Kiner 9301 (heat softening temperature of 80 °), a Daikin Industries, LTD. make trade name 2 liquefied fluoro-resin, The finishing agent of G101 and Daikin Industries, LTD. make trade name 3 powder : A carbon functional silane, KBM-3103, a Shin-Etsu Chemical Co., Ltd. make trade name 4 thermal-conductivity filler : Alumina powder, AS30, Showa Denko K.K. make trade name 5 electromagnetic-wave-absorbing nature filler:Fe-Cr (metal system soft magnetism spherical powder), PMIC-15, Daido Steel Co., Ltd. make trade name 6 electromagnetic-wave-absorbing nature filler:Fe-Cr (metal system soft magnetism flat shape powder), PMIC-15F, the trade name by Daido Steel Co., Ltd.

[0057]Agitation mixing of the raw material of the combination formula shown in thermosoftening electromagnetic-wave-absorbing nature radiation sheet production procedures and the quality assessment table 2 was carried out by the kneader. The extruder performed extrusion molding for the obtained compound, and the sheet (300 mm in width and 0.5 mm in thickness) was produced on the PET film.

[0058]After piercing and molding the obtained thermosoftening sheet in predetermined shape and removing the PET film, a noise extinction ratio, thermal conductivity, thermal resistance, viscosity, and a heat softening point were measured by the same method as Example 1. Sheet processability, pliability, tack nature, and handling nature were similarly estimated as Example 1. These results were shown in Table 2.

[0059]

[Table 2]

原料 (重量部)	実施例 5	実施例 6	実施例 7	実施例 8
34F-9801	0	100	0	100
G101	200	100	200	100
KBM-3103	5	5	5	5
AS30	0	600	0	300
PMIC-15	1000	1000	0	0
PMIC-15F	0	0	450	450
ノイズ減衰量 at 1GHz(dB)	-18.2	-9.8	-14.5	-18.1
可塑度 at 25°C	310	600	250	800
熱伝導率(W/mK)	1.7	4.4	1.2	2.1
熱膨張 at 60°C(°C/W)	0.09	0.03	0.10	0.06
粘度 at 80°C(Pa·s)	5×10^2	3×10^2	2×10^2	1×10^4
熱軟化点(°C)	40~80	40~80	40~80	40~80
シート加工性	○	○	○	○
柔軟性	◎	△	◎	○
タック性	◎	○	◎	◎
取り扱い性	△	△	△	△

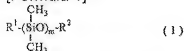
[0060][Examples 9-18 and comparative example 1] The softening temperature which consists of a mixture which uses silicone resin and an electromagnetic-wave-absorbing nature filler as the main ingredients produced the thermosoftening electromagnetic-wave-absorbing nature radiation sheet which formed a not less than 40 ° silicone series thermal-conductivity electromagnetic-wave-absorbing nature constituent in the sheet shaped by the following procedure.

[0061]As a heat softening ingredient of a silicone series thermal-conductivity electromagnetic-wave-absorbing nature constituent, $\text{CH}_3\text{SiO}_3/2$, $2 (\text{CH}_3)_2\text{SiO}$, Methylphenyl

silicone resin which is a copolymer made combining the structural unit of $C_6H_5SiO_{3/2}$, SiO ($CH(C_6H_5)$ 3), and 2 (C_6H_5) SiO was used. As a matrix component, two kinds of vinyl group content dimethylpolysiloxane from which viscosity differs was used. The organopolysiloxane which contains the silicon atom joint alkoxy group shown with a following general formula (1) as other ingredients was added as a finishing agent of an electromagnetic-wave-absorbing nature filler and a thermally conductive filler.

[0062]

[Formula 1]



(R^1 among a formula any one sort of CH_3 and the OH) [express and] R^2 expresses any one sort of $Si(OCH_3)_3$, $Si(OC_2H_5)_3$, $Si(CH_3)_2OH$, and the $Si(CH_3)_2NH_2$. m expresses arbitrary or more 1 100 or less integers.

In order to improve the detachability from the liner at the time of sheet wearing, the dimethyldiphenylpolysiloxane was used as an internal release agent. A feed ingredient ingredient is shown below.

[0063]Raw material explanation 1 heat-softening ingredient : Methylphenyl silicone resin $CH_3SiO_{3/2}$, $(CH_3)_2SiO$, $C_6H_5SiO_{3/2}$, (C_6H_5) The copolymer and softening temperature which was made combining the structural unit of SiO and 2 (C_6H_5) SiO compound and use a thing (40 ** (resin A) and 60 ** (resin B)) (CH_3).

2) Matrix component : use two kinds of vinyl group content dimethylpolysiloxane. Hyperviscous ingredient : Crude rubber KE-76VBS, Shin-Etsu Chemical Co., Ltd. make trade name hypoviscosity ingredient:30000cSt vinyl group content dimethyl oil, The finishing agent of Shin-Etsu Chemical Co., Ltd. make 3 powder : Organopolysiloxane containing a silicon atom joint alkoxy group, 4 internal release agent by Shin-Etsu Chemical Co., Ltd. : A dimethyldiphenylpolysiloxane, KF-54, a Shin-Etsu Chemical Co., Ltd. make trade name 5 thermal-conductivity filler : Alumina powder, AS30, a Showa Denko K.K. make trade name 6 thermal-conductivity filler : Aluminum nitride powder, UM, a Toyo Aluminium K.K. make trade name 7 thermal-conductivity filler : Silicon carbide powder, GP#1000, product trade name made from Shinano Electrefining 8 electromagnetic-wave-absorbing nature filler:Fe-Cr (metal system soft magnetism spherical powder), PMIC-15, Daido Steel Co., Ltd. make trade name 9 electromagnetic-wave-absorbing nature filler:Fe-Cr (metal system soft magnetism flat shape powder), PMIC-15F, a Daido Steel Co., Ltd. make trade name 10 electromagnetic-wave-absorbing nature filler:Mn-Zn ferrite (oxide stock soft magnetism flat shape powder), BSF547, Toda Kogyo Corp. make trade name 11 electromagnetic-wave-absorbing nature filler:Fe-nickel (metal system soft magnetism spherical powder), MHT permalloy PC, Mitsubishi Steel Mfg. Co., Ltd. make trade name 12 electromagnetic-wave-absorbing nature filler : in order [which are Fe-Cr-Si (metal system soft magnetism spherical powder), MHT410L-3Si, and a trade name by Mitsubishi Steel Mfg. Co., Ltd.] to raise reworkability, With the heat by operation of an exothermic electronic component, in making the silicone matrix of a thermosoftening electromagnetic-wave-absorbing nature radiation sheet construct a bridge (example 18), Addition mixing of the ORGANO hydrogen polysiloxane which contained two or more hydrogen atoms combined with the silicon atom in one molecule, a platinum metal system catalyst, and the acetylene alcohol system reaction controlling agent was carried out.

[0064]The raw material of the combination formula shown in thermosoftening

[Table 3]

[Table 4]

原料 (重量部)	実施例 15	実施例 16	実施例 17	実施例 18	比較例 1
レジソ A	25	0	25	25	25
レジソ B	0	25	0	0	0
KE-76VBS	20	10	10	10	10
30000cSt ビニル基含有 ポリオレフィン	40	40	40	40	40
ケイ素原子結合アロキシ 基を含有するオレフィン ポリオレフィン	10	20	20	20	20
KF-54	5	5	5	5	5
オレフィンポリオレフィン ポリオレフィン	0	0	0	2.0	0
白金族金属系触媒	0	0	0	0.2	0
アセチレン系反応抑制 剤	0	0	0	0.4	0
AS30	0	0	0	400	1200
UM	0	0	0	0	0
GP#1000	0	0	0	0	0
PMIC-15	900	900	400	600	0
PMIC-15F	0	0	150	0	0
BSP547	0	0	0	300	0
ロス減衰量 at 1GHz (dB)	-10.7	-11.1	-11.2	-10.7	0
可塑性 at 250°C	410	530	290	410	350
熱伝導率(W/mK)	1.2	1.3	1.0	2.5	4.1
熱抵抗 at 60°C (°C/W)	0.04	0.10	0.08	0.06	0.03
粘度 at 80°C (Pa·s)	8×10^4	5×10^3	5×10^3	1×10^4	5×10^4
熱軟化点(°C)	40~60	60~80	40~60	40~60	40~60
シート加工性	○	○	△	○	○
柔軟性	○	◎	◎	○	○
クック性	○	○	○	△	○
取り扱い性	○	△	○	○	○

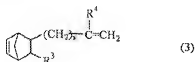
[0068] Although the ease of removing from the heat sink and CPU of a thermosoftening electromagnetic-wave-absorbing nature radiation sheet after setting the thermosoftening electromagnetic-wave-absorbing nature radiation sheet to a heat sink and CPU-to-CPU and operating CPU as reworkability evaluation for 3 hours was evaluated, By having made the sheet construct a bridge in Example 18, reworkability was able to improve and it was able to remove finely easily by wiping off the affix of a thermosoftening electromagnetic-wave-absorbing nature radiation sheet with the dry cloth.

[0069][Examples 19-31 and comparative examples 2-4] The softening temperature which consists of a mixture which uses polyolefine and an electromagnetic-wave-absorbing nature filler as the main ingredients produced the thermosoftening electromagnetic-wave-absorbing nature radiation sheet which formed a not less than 40 ** polyolefin system thermal-conductivity electromagnetic-wave-absorbing nature constituent in the sheet shaped by the following procedure.

[0070] As a heat softening ingredient of a polyolefin system thermal-conductivity electromagnetic-wave-absorbing nature constituent, it is a following general formula (2).
 $\text{CH}_2=\text{CH}(\text{CH}_2)_n\text{CH}_3$ (2)

(n is 16-50.) -- the alpha olefin shown was used. As a matrix component, the ethylene, alpha olefin, and disconjugate polyene random copolymer rubber shown were used with the following general formula (3) and (4).

[Formula 2]



(x is an integer of 0-10 among a formula, R^3 is an alkyl group of a hydrogen atom or the carbon numbers 1-10, and R^4 is an alkyl group of a hydrogen atom or the carbon numbers 1-5.)

[Formula 3]



(R^5 is an alkyl group of a hydrogen atom or the carbon numbers 1-10 among a formula.) In order to give pliability and tuck nature to a sheet, it is a following general formula (5) again. $[(\text{CH}_2-\text{CH}_2) \text{X}-(\text{CH}_2-\text{CRH}) \text{Y}] \text{P} \quad (5)$

(R is an alkyl group expressed with $\text{C}_W\text{H}_{2W+1}$ here, X, Y, P, and W are integers, and, as for 1-100Y, 5-500W of 5-100P are usually 1-10 X.) – the polymer from which the viscosity shown differs was used. A feed ingredient ingredient is shown below.

[0071]Raw-material explanation 1 matrix component: Ethylene, alpha olefin, and disconjugate polyene random copolymer EPT-PX055 (Mooney viscosity (100 **) 8, 58 % of the weight of ethylene contents, trade name by Mitsui Chemicals, Inc.)

EPT-4010 (Mooney viscosity (100 **) 8, 65 % of the weight of ethylene contents), Mitsui Chemicals, Inc. make trade name EPT-4021 (Mooney viscosity (100 **) 24, 67 % of the weight of ethylene contents), Trade name EPT-X 3012P (Mooney viscosity (100 **) 15, 70 % of the weight of ethylene contents) by Mitsui Chemicals, Inc., The trade name 2 matrix component by Mitsui Chemicals, Inc. : Ethylene and alpha olefin copolymer roux cant HC40 (viscosity 350cSt (25 **)), Trade name HC3000by Mitsui Chemicals, Inc. X (viscosity 25000cSt (25 **)), Trade name HC10 by Mitsui Chemicals, Inc. (viscosity 140cSt (25 **)), Mitsui Chemicals, Inc. make trade name 3 heat-softening ingredient : Alpha olefin die YAREN 30 (n= 30-40), Mitsubishi Chemical trade name die YAREN 208 (n= 17-25), a Mitsubishi Chemical trade name 4 thermal-conductivity filler : Alumina powder, AS30, a Showa Denko K.K. make trade name 5 thermal-conductivity filler : Aluminum nitride powder, UM, a Toyo Aluminium K.K. make trade name 6 thermal-conductivity filler : Silicon carbide powder, GP#1000, product trade name made from Shinano Electrorefining 7 electromagnetic-wave-absorbing nature filler:Fe-Cr (metal system soft magnetism spherical powder), PMIC-15, Daido Steel Co., Ltd. make trade name 8 electromagnetic-wave-absorbing nature filler : Fe-Cr (metal system soft magnetism flat shape powder), PMIC-15F, a Daido Steel Co., Ltd. make trade name 9 electromagnetic-wave-absorbing nature filler:Mn-Zn ferrite (oxide stock soft magnetism flat shape powder), BSF547, Toda Kogyo Corp. make trade name 10 electromagnetic-wave-absorbing nature filler:Fe-nickel (metal system soft magnetism spherical powder), MHT permalloy PC, Mitsubishi Steel Mfg. Co., Ltd. make trade name 11 electromagnetic-wave-absorbing nature filler:Fe-Cr-Si (metal system soft magnetism spherical powder), The finishing agent of MHT410L-3Si and Mitsubishi Steel Mfg. [Co., Ltd.] make trade-name 12 powder: A carbon functional silane, KBM-3103, the trade name by Shin-Etsu Chemical Co., Ltd. [0072]The raw material of the combination formula shown in thermosoftening electromagnetic-wave-absorbing nature radiation sheet production procedures and the quality assessment tables 5 and 6 was supplied to the planetary mixer, and agitation mixing was carried out at 100 ** for 2 hours. Next, the compound obtained by carrying out deaeration mixing with 2 rolls at the room temperature was extruded and molded

into 100 mm in width, and 0.5 mm in thickness by the extruder, and it was processed into the sheet shaped.

[0073] The obtained thermosoftening sheet was pierced and molded in predetermined shape, and a noise extinction ratio, thermal conductivity, thermal resistance, viscosity, and a heat softening point were measured by the same method as Example 1. Sheet processability, pliability, tuck nature, and handling nature were similarly estimated as Example 1. These results were shown in Tables 5 and 6.

[0074]

[Table 5]

原料 (重量部)	実施例 19	実施例 20	実施例 21	実施例 22	実施例 23	実施例 24	実施例 25	実施例 26
EPT-PX066	20	0	0	0	20	10	20	20
EPT-4010	0	20	0	0	0	10	0	0
EPT-4021	0	0	30	0	0	0	0	0
EPT-X3012P	0	0	0	20	0	0	0	0
エポト HC10	0	0	0	0	0	0	5	10
エポト HC3000X	30	30	30	30	30	30	25	30
ダイヤル 20	20	20	20	20	20	20	20	10
ダイヤル 208	30	30	30	30	30	30	30	30
KBM-S109	6	6	6	6	6	6	6	6
AS30	0	0	0	0	0	400	400	400
UM	0	400	0	0	0	0	0	0
OPW1900	0	0	400	0	0	0	0	0
PMIC-16	900	900	900	0	0	900	900	900
PMIC-16P	0	0	0	200	0	0	0	0
B8P647	0	0	0	0	800	0	0	0
ノイズ減衰量 at 1 GHz (dB)	-11.0	-11.5	-11.4	-12.2	-5.5	-11.0	-11.2	-11.1
可塑性 at 26°C	340	360	450	500	350	420	290	310
熱伝導率 (W/mK)	0.9	2.3	2.5	1.0	1.3	2.4	2.3	2.2
熱抵抗 at 60°C (°C/W)	0.09	0.08	0.06	0.09	0.10	0.06	0.05	0.04
粘度 at 80°C (Pa·s)	1×10 ⁴	5×10 ³	6×10 ⁴	8×10 ⁴	3×10 ⁴	8×10 ⁴	2×10 ⁴	8×10 ⁴
熱軟化点 (°C)	40~80	40~80	40~80	40~80	40~80	40~80	40~80	40~80
シート加工性	○	○	○	○	○	○	○	○
柔軟性	△	△	△	△	△	△	△	○
タック性	△	△	△	△	△	△	△	○
取り扱い性	△	△	△	△	○	○	○	△

[0075]

[Table 6]

原料 (重量部)	実施例 27	実施例 28	実施例 29	実施例 30	実施例 31	比較例 2	比較例 3	比較例 4
EPT-4010	10	10	10	10	10	0	0	10
EPT-PX065	10	10	10	10	10	20	20	10
セグメント HC10	10	10	10	10	10	0	0	0
セグメント HC3000X	20	20	20	20	20	30	30	30
グーテン 30	20	20	20	20	20	20	20	20
グーテン 208	30	30	30	30	30	30	30	30
KBM-8103	6	6	6	6	6	6	6	6
AS30	400	400	300	300	600	0	1200	0
PMIC-15	600	0	0	300	100	1000	0	0
PMIC-15F	160	0	0	50	200	0	0	0
MHT ベース (PC)	0	900	0	460	100	0	0	0
MHT410-38i	0	0	1000	200	100	0	0	0
/Δ'減衰量 at1GHz (dB)	-14.0	-12.0	-11.6	-15.0	-15.6	-13.0	0	0
可塑性 at25℃	400	430	440	440	440	400	310	測定 不可
熱伝導率(W/mK)	2.4	2.3	2.2	2.4	2.3	1.8	3.0	0.3
熱抵抗 at80℃ (℃/W)	0.03	0.04	0.05	0.03	0.05	0.09	0.03	1.2
粘着 at80℃ (Pa·s)	1.5×10^4	1×10^4	7×10^3	2×10^4	8×10^3	5×10^4	8×10^3	40
熱軟化点(℃)	40~80	40~80	40~60	40~80	40~80	40~80	40~80	測定 不可
シート加工性	◎	○	○	○	○	○	○	×
柔軟性	◎	◎	○	◎	○	○	○	×
タック性	◎	◎	◎	◎	○	○	○	×
取り扱い性	◎	◎	◎	◎	○	○	○	×

[0076][Comparative examples 5-8] The physical-properties measurement result and handling sex-test result of a silicone rubber radiation sheet (0.5 mm (comparative examples 5-7) in thickness) and grease (comparative example 8) which are marketed for comparison are shown in Table 7.

[0077]

[Table 7]

	比較例 5	比較例 6	比較例 7	比較例 8
/Δ'減衰量 at1GHz (dB)	0	0	0	0
熱伝導率(W/mK)	3.0	3.0	4.0	4.7
熱抵抗 at80℃ (℃/W)	0.56	0.47	0.27	0.03
取り扱い性	△	△	○	×

[0078]From the above-mentioned result, the thermosoftening electromagnetic-wave-absorbing nature radiation sheet of the example of this invention, It was checked that having the radiation performance which was excellent in even the level which thermal contact resistance can disregard falling as compared with a silicone rubber radiation sheet with comparable thermal conductivity from thermal resistance becoming small is checked, and heat dissipation of electronic parts has an effect. It was checked that a noise extinction ratio has the highly outstanding electromagnetic-wave-absorbing performance.

[0079]

[Effect of the Invention]According to this invention, it excels in radiation performance and the thermosoftening electromagnetic-wave-absorbing nature radiation sheet which formed an electromagnetic-wave-absorbing nature heat-conduction constituent and this excellent in electromagnetic-wave-absorbing nature in the sheet shaped is obtained.

[Translation done.]